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VEGETABLE RESEARCH RESULTS 2008

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INDEX

INTRODUCTION

This report summarizes the results of several vegetable studies conducted during 2008. We hope this type of information is of benefit to the vegetable industry in Ohio and the Great Lakes region. These reports and others are also available on the OSU Vegnet wesite at: http://vegnet.osu.edu. Your comments and suggestions for future efforts are always welcome.

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- *Seedway*
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- *Rispen Seeds*
- *Long & Sweet LLC*
- *Harris Moran*
- *Rogers*

Special thanks and appreciation to Sean Mueller, Jordan Miller, Nancy Sluder and the crew at the OARDC North Central Agricultural Research Station, Fremont, OH for their assistance with plot establishment, maintenance, harvesting and grading.

Use of Biological Seed Treatments for Improved Seedling Establishment and Disease Control in Sweet Corn

Principle Investigators: Mark Bennett and Elaine Grassbaugh (Hort &Crop Science)

Other Personnel: Brian McSpadden-Gardener (Plant Pathology)
and Matt Hofelich (OARDC)

Introduction:

This project focuses on the use of organic/biological seed treatments for optimum stand establishment of sweet corn. Traditional seed treatments due to their composition, cannot be used in organic production systems. Use of untreated seed often reduces seed germination and field stands. Organic/biological treatments may be useful to organic and transitional farmers when direct seeding crops such as sweet corn. This project assessed establishment when sown under lab and field conditions.

Materials and Methods:

Sweet corn 'Obsession' seed (*sh_2*) was treated with various biological treatments: (Green Guard™, Actinovate®, Delaw1 strain) as well as Thiram, an untreated control and a water control. Seeds were tested in the lab using standard germination and cold tests. Field plots were established on a Rimer loamy fine sand at the OSU/OARDC North Central Ag Research Station (NCARS), Fremont, OH. Fifty seeds per plot were planted 6 inches apart with 30 inches spacing between rows. All treatments were replicated 4 times. Seed treatments were applied on June 16 and plots were seeded on June 18. Soil temperature (2" depth) at planting was 61.3°F (16.3°C). Stand counts were taken on July 15.

Results:

There were no significant differences due to seed treatment in standard germination or laboratory cold tests. Field stand counts showed a significantly higher percent germination/stand (92-93%) for seeds treated with Actinovate, the untreated control and the water control (Table 1). Delaw1 (90%) and Green Guard (85%) presented intermediate levels of seedling establishment. Thiram treated seed had the lowest percent stand (Table 1). Soil temperature stress was minimal for the 2008 field studies, and lower seedling establishment levels are typically observed when planting untreated sweet corn seed. Future studies in Ohio with a wider range of sweet corn germplasm and biological seed treatments under cooler soil conditions (50-60 degrees F) are needed.

Conclusion:

Growers looking to grow produce in a more sustainable and reliable manner can benefit from effective seed treatments for uniform seedling establishment and disease control. This would especially be important to those looking to transition to organic production where traditional seed treatments are not labeled for organic production. Additional work is needed to provide more data on these and other treatments.

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- Thanks and appreciation to the Ohio Vegetable and Small Fruit Research and Development Program for their financial support
- Special thanks to Natural Industries, Inc. for their donation of Actinovate®
- We express our appreciation to Seminis for their seed donation for this project

Table 1. Effect of various seed treatments on standard laboratory germination and cold test results, and seedling establishment (4 WAS) in the field of an *sh*$_2$ sweet corn cultivar ('Obsession'), Fremont, OH – 2008.

Seed Treatment	Active Ingredient/Beneficial Microorganism	Std. germ (%)	Cold test (%) germ	Field stand count (%)
Control		99	99	93
Water Control		99	95	92
Thiram	*Tetramethylthiuram disulfide*	100	96	77
Green Guard™	*Metarhizium anisopliae*	100	99	85
Actinovate®	*Streptomyces lydicus*	99	95	92
Delaw1	*Pseudomonas fluorescens*	100	96	90
LSD (0.05)		NS	NS	2.01
p value		0.701	0.29	
CV		1.3	3.6	9.5

ABA for Transplant Height Control in Processing Tomatoes – 2008

Investigator: Dr. Mark Bennett
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Test Site: OSU/OARDC North Central Ag Research Station, Fremont, OH

Start Date: April 25, 2008

Completion Date: October, 2008

Report Date: October, 2008

Abstract: ABA application to processing tomato transplants at the rates of 200 ppm and 400 ppm were effective in reducing transplant height prior to transplanting to the field. Height reductions were noted 1 week after field establishment but had no effect on height, stem diameter, field survival or plant dry weight 3 weeks after transplanting. There were no differences in yield, average fruit size or percent red fruit at harvest.

Introduction:

Methods and Materials: Processing tomatoes ('Peto 696') were seeded into 288-cell plug trays (plug volume 7.2 cm^3) on April 25, and grown at the North Central Ag Research Station greenhouse. Soilless mix (Metro-Mix® 360) was used to produce our trnsplants. ABA solutions were applied at the rate of ~ 3ml/plug according to the following treatments: Untreated (water) control, 200 ppm 5 days prior to transplanting and 1 day prior to transplanting, 200ppm 5 days prior to transplanting and 400 ppm 5 days prior to transplanting. Plant heights and stem diameters were recorded before the ABA applications were made. Plots (25 feet long) were established in rows spaced 5 feet apart and an in-row plant spacing of 12 inches apart on May 27, 2008 using a mechanical transplanter. Soil type was a Hoytville silty clay loam. Each treatment was replicated 4 times. One week after transplanting, plant heights were recorded for 3 plants from each replication. Three weeks after transplanting, plant height, stem diameter, percent survival and dry weights of three plants were recorded. Plant heights were again measured 7 weeks after field transplanting.

Plots were harvested on September 26, 2008. Red, green and culled fruit were weighed, calculating average fruit size and percent red fruit at the time of harvest. Data were analyzed using Systat™.

Results: No significant differences (0.05 level) were detected for plant measurements 3 and 7 weeks after transplanting. However, there was a significant difference in plant heights taken 1 week after field establishment showing all the ABA treatments significantly reduced plant height compared to the untreated control (Table 1).

Yields ranged from 12.9 T/A to 15.2 T/A for marketable red fruit but were not significantly different (p value = 0.195). There were no differences due to ABA treatments in green, culled fruit, average fruit size and percent red fruit at harvest. The 2008 tomato yields at NCARS were less than half of normal due to a wet early season and very dry August.

Summary: ABA application to processing tomato transplants controlled height for at least one week after transplanting to the field, but did not effect plant development later in the season (data recorded at 3 and 7 weeks after field establishment). ABA application did not adversely effect yield, average fruit size or percent red fruit at harvest. This is consistent with results from prior years showing ABA controls plant height early on without reducing final tomato fruit yields.

Conclusions: ABA is effective for tomato transplant height control early in the season. ABA use could be important when spring planting may be delayed due to wet, cool growing conditions. Temporary reductions in tomato plant height can be achieved with an application of ABA without adverse effects on subsequent plant development and final yield.

Recommendations: Additional greenhouse and/or field work in the future could focus on the use of ABA on other vegetable transplants and to measure the duration and extent of height reduction in transplants. Other possible crops may include peppers, or cucurbits. Cucurbit transplants develop quickly after seeding and delays in transplanting to the field cause the plants to get long and leggy, requiring hand planting to establish plots in the field. ABA could also be compared to other seed/plant applied growth regulators for efficacy comparisons.

2008 Weather Data for the North Central Ag Research Station in Fremont, OH:

Month	Average Temperature (^{o}F)	Total Precipitation
May	57.7	3.99
June	71.2	4.08
July	73.5	3.90
August	70.3	0.46
September	65.7	N/A

Acknowledgements:

- Special thanks to Valent BioSciences Corp. for their financial support and ABA for this project.

- Thanks and appreciation to Sean Mueller, Jordan Miller and the crew at NCARS for their assistance with plot establishment, maintenance and harvest.

Table 1. ABA Height Control Study on Processing Tomatoes – Fremont, OH; 2008

Cultivar: 'Peto 696'

				---------3 weeks after transplant------				
Treatment	**Plt ht pre-ABA treatment (cm.)**	**Stem diam pre-ABA treatment (mm)**	**Plant ht (cm.) 1 WAT**	**Plant ht (cm.)**	**Stem diam (mm)**	**Survival (%)**	**Dry wt (g) of 3 plants**	**Plant ht (cm.) 7 WAT**
Water Control	11.8	2.65	16.2	20.8	8.08	95	15.4	43.8
200 ppm 5DBT* + 200 ppm 1DBT	11.8	2.85	13.4	20.6	7.83	92	13.1	42.5
200 ppm 5DBT*	11.8	2.75	13.2	19.6	8.25	93	15.5	41.1
400 ppm 5DBT	11.5	2.65	13.4	19.3	7.63	97	13.1	43.4
LSD (0.05)	NS	NS	0.63	NS	NS	NS	NS	NS
p value	0.873	0.091		0.496	0.228	0.487	0.531	0.462
CV	4.1	4.9	9.5	7.8	5.7	5.1	21.9	6.1

YIELD DATA

Treatment	**Red T/A**	**Green T/A**	**Culls T/A**	**Average fruit size (lb)**	**Percent red fruit**
Water Control	15.2	9.3	5.2	0.09	53
200 ppm 5DBT* + 200 ppm 1DBT	13.5	8.6	4.8	0.10	50
200 ppm 5DBT*	15.1	8.3	4.7	0.10	54
400 ppm 5DBT	12.9	8.9	5.0	0.10	49
LSD (0.05)	NS	NS	NS	NS	NS
p value	0.195	0.899	0.906	0.617	0.591
CV	13.7	27.0	36.7	10.3	16.9

* DBT = days before transplanting

Plant Population and Cultivar Selections for Optimum Yield in Processing Tomatoes – 2008

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Objective: to test 3 processing tomato cultivars planted at 3 plant populations for optimum yields and quality.

Materials and Methods: Transplants of three processing tomato cultivars ('TSH 4', 'Gem 331', and 'H9704') were obtained from Hirzel's and planted to the field at the North Central Ag Research Station in Fremont, OH. Variety selection was based on using an early, mid-season and late season maturing cultivar. Plots were established on a Hoytville silty clay loam in 4 replications and twin rows. Plant populations for each cultivar were 6,500, 8,700, 10,500, and 13,100 plants/A using in-row plant spacings of 32, 24, 20 and 16 inches apart, respectively. Twin rows were spaced 18 inches apart. Plants were transplanted to the field on May 22, 2008. 'TSH 4' and 'Gem 331' were machine harvested on September 4, and 'H9704' was machine harvested on September 23. Marketable red, green and culled fruit yields were calculated along with percent red fruit at harvest and average fruit size based on 50 fruit from each replication.

Results: Yields were below normal in 2008 in all varieties, due to a wet spring and very hot, dry summer. The longer maturing cultivar 'H9704' had higher yields in all plant populations compared to 'TSH 4' and 'Gem 332' (Table 1). There were no differences in yield, average fruit size or percent red fruit at harvest for the early maturing ('TSH 4') and mid-season maturing ('Gem 331') cultivars. Yields for 'H9704' showed no differences due to plant population in red or green fruit yields, average fruit size and percent red fruit at harvest, but there was a significant difference in culled fruit with a significant increase at populations of 10,500 and 13,100 plants per acre (Table 1). Average fruit size ($p=0.13$) and percent red fruit ($p=0.06$) for 'H9704' tended to peak at the 8,700 plants/A density.

Conclusion: With increasing costs of processing tomato transplants and variations in yield potential between cultivars, more research is needed to determine the optimum plant population for specific cultivars for maximum marketable yields and cost efficiency.

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- Special thanks and appreciation to Mid-American Food Processors Association for their financial support of this project.
- Appreciation is extended to Hirzel's for supplying tomato transplants
- Special thanks to Sean Mueller, Jordan Miller, Nancy Sluder and the summer crew at the North Central Ag Research Station for their assistance with plot establishment, maintenance and harvest.

Table 1. Plant Population and Cultivar Selections for Optimum Yield in Processing Tomatoes - 2008

Cultivar: 'TSH 4'

Plant Population (# plants/A)	In-row spacing (inches)	Red T/A	Green T/A	Cull T/A	Average fruit size (lb.)	Percent red fruit at harvest
6500	32	8.5	3.0	3.4	0.12	56
8700	24	6.9	2.5	3.1	0.12	55
10500	20	8.1	3.1	3.7	0.11	53
13100	16	9.4	3.7	3.2	0.12	57
LSD (0.05)		NS	NS	NS	NS	NS
p value		0.297	0.468	0.218	0.349	0.805
CV		28.8	33.0	22.0	14.3	15.1

Cultivar: 'Gem 331'

Plant Population (# plants/A)	In-row spacing (inches)	Red T/A	Green T/A	Cull T/A	Average fruit size (lb.)	Percent red fruit at harvest
6500	32	7.1	3.8	3.8	0.11	47
8700	24	8.1	3.4	3.7	0.11	49
10500	20	8.3	3.2	4.3	0.10	53
13100	16	9.7	3.0	4.0	0.10	58
LSD (0.05)		NS	NS	NS	NS	NS
p value		0.51	0.196	0.531	0.48	0.425
CV		36.3	29.8	15.5	18.1	20.4

Cultivar: 'Heinz 9704'

Plant Population (# plants/A)	In-row spacing (inches)	Red T/A	Green T/A	Cull T/A	Average fruit size (lb.)	Percent red fruit at harvest
6500	32	9.7	5.9	6.1	0.10	44
8700	24	14.1	5.2	5.2	0.12	53
10500	20	12.1	5.8	7.9	0.10	45
13100	16	11.8	5.8	7.6	0.11	46
LSD (0.05)		NS	NS	1.34	NS	NS
p value		0.21	0.41		0.13	0.06
CV		51.5	18.6	22	25.5	15.7

New Vegetable Cultivar Releases for 2008

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Objective: to test new vegetable variety releases in 2008 for their performance under northwest Ohio growing conditions and to determine new releases showing pest resistance.

Materials and Methods: Twenty-eight varieties of various vegetable crops were planted in 4 replications at the North Central Ag Research Station (NCARS), Fremont, OH. Cultivar selections were new releases for 2008 along with varieties considered industry standards. Much input was received from growers, seed companies and industry personnel regarding variety selection and those used as a standard comparison. Peppers (bells, banana and jalapeno), fresh market tomatoes, plum/roma-type tomatoes, eggplant, winter squash and gourds were included in this project. Transplants were seeded and grown at NCARS and transplanted to the field during May and June. Plots were established in 4 replications per cultivar on a Hoytville silty clay loam soil. Tomatoes were harvested 4 times, peppers 3 times, eggplant 3 times, and winter squash and gourds once.

Results: Seven fresh market tomato varieties were compared and we found no significant differences in yield or average fruit size. There was a significant amount of blossom end rot, bacterial spot and bacterial speck throughout the plots. Two heritage (heirloom) tomato cultivars ('Red Zebra' and 'Conestoga') were also planted. There was a significant difference in yield and average fruit size, with 'Conestoga' yielding 35.4 T/A red fruit and an average fruit size of .41 lb, compared to 'Red Zebra' that yielded 8.9 T/A red fruit and an average fruit size of .19 lb. The majority of culls in both varieties was fruit cracking (Table 1). Green yields were fruit of marketable size that were picked at the last harvest but not yet at the breaker stage.

Two plum tomato varieties were tested with no significant differences in yield but a slight difference in average fruit size. Both varieties ('Picus', 'Tormenta') were large-fruited with very few culled fruits and excellent disease resistance (Table 1).

One variety each of eggplant ('Irene'), butternut squash ('Matilda'), and gourd ('Lunch Lady') were trialed as new releases for 2008. Again, they all showed good disease resistance with good marketable yields and few culled fruits (Table 1).

Seven varieties of bell peppers were researched. Yields ranged from 4.1 T/A to 7.3 T/A. Top yielding varieties were 'Karisma', 'Declaration' and 'Flavor Burst'. Average fruit size ranged from .37-.48 lb. Culled fruits were mainly from blossom end rot and sunscald (Table 2).

Five varieties of jalapenos were tested. There were no significant differences in yield or average fruit size. Marketable yields ranged from 8.2 to 10.5 T/A with very few culled fruit in any of the varieties (Table 2).

Four banana/snack type pepper varieties were included in this study. There were no significant differences in marketable yield and slight differences in cull T/A, and average fruit size. Culled fruits were due to blossom end rot (Table 2).

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  Seedway
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  Rispen Seeds
  Long & Sweet LLC
  Harris Moran
  Rogers
- Thanks and appreciation to Jordan Miller, Sean Mueller, Nancy Sluder and the summer crew at the North Central Ag Research Station for their assistance with seeding, planting, harvesting and fruit grading.

Table 1. New Vegetable Cultivar Releases for 2008

FRESH MARKET TOMATOES:

Variety	Status	Maturity	Seed Source	Marketable T/A	Cull T/A	Green T/A	Average fruit size (lb)
Polbig	New 2008	61 day	SW	14.5	32.9	3.0	0.54
Mountain Glory	New 2008	70 day	Rogers	18.6	29.0	4.2	0.52
Phoenix	New 2007	72 day	SM	15.8	28.3	3.7	0.45
Rocky Top	New 2008	NA	Rogers	15.6	33.2	4.2	0.49
Fletcher	New 2008	74 day	SW	13.2	28.5	6.2	0.47
Mountain Fresh Plus	Industry Std.	77 day	SW	17.2	29.3	4.9	0.54
LSD (0.05)				NS	NS	NS	NS
CV				39.5	17.0	46.9	19.3

HEIRLOOM TOMATOES:

Variety	Status	Maturity	Seed Source	Marketable T/A	Cull T/A	Green T/A	Average fruit size (lb)
Red Zebra	New 2008	75 day	Seeedway	8.9	18.7	1.6	0.19
Conestoga	New 2008	NA	Harris Moran	35.4	28.6	5.0	0.41
LSD (0.05)				11.53	5.63	3.24	0.19
CV				72.6	24.1	89.5	39.1

Table 1 (continued)

PLUM TOMATOES:

Variety	Status	Maturity	Seed Source	Marketable T/A	Cull T/A	Green T/A	Average fruit size (lb)
Picus	New 2007	74 day	SM	47.8	11.2	5.6	0.20
Tormenta	New 2008	72 day	SW	56.3	6.8	7.1	0.16
LSD (0.05)				NS	NS	NS	0.03
CV				18.3	47.2	56.2	12.9

EGGPLANT:

Variety	Status	Maturity	Seed Source	Marketable T/A	Cull T/A	Average fruit size (lb)
Irene	New 2008	65 day	SW	12.0	1.8	1.0

BUTTERNUT SQUASH:

Variety	Status	Maturity	Seed Source	Marketable T/A	Cull T/A	Average fruit size (lb)
Matilda	New 2008	90 day	SW	25.2	1.9	6.0

GOURD:

Variety	Status	Maturity	Seed Source	Marketable T/A	Cull T/A	Average fruit size (lb)
Lunch Lady	New 2008	120	SW	19.9	1.5	7.1

Table 2. New Vegetable Cultivar Releases for 2008

BELLS:

Variety	Description	Status	Maturity	Seed Source	Marketable T/A	Cull T/A	Average fruit size (lb)
PS9927141	Green to Red	New 2008	72 day	SM	4.3	4.1	0.38
PS0928302	Green to Red	New 2008	75 day	SM	4.1	3.1	0.45
PS1819	Green to Red	New 2008	75 day	SM	5.3	2.3	0.45
Karisma	Green to Red	New 2008	72 day	SW	7.3	2.3	0.48
Declaration	Green to Red	New 2008	70 day	SW	6.0	1.7	0.44
Aristotle	Green to Red	Industry Std.	70 day	SM	5.2	3.3	0.46
Flavor Burst	Green to Yellow	New 2008	65 day	SW	6.0	1.8	0.37
LSD (0.05)					1.8	1.53	NS
CV					37.8	50.5	16.8

JALAPENO:

Variety	Description	Status	Maturity	Seed Source	Marketable T/A	Cull T/A	Average fruit size (lb)
Regalo	Jalapeno	New 2008	NA	Orsetti	9.3	0.2	0.05
Talon	Jalapeno	Industry Std.	75 day	RI	8.2	1.1	0.06
Chichimeca	Jalapeno	New 2008	73 day	SM	10.1	0.6	0.06
Chapala	Jalapeno	New 2008	73 day	SM	9.4	0.1	0.06
Ixtapa	Jalapeno	Industry Std.	75 day	SM	10.5	0.1	0.06
LSD (0.05)					NS	NS	NS
CV					17.5	15.4	11.7

Table 2.
(continued)

BANANA/SNACK TYPE:

Variety	Description	Status	Maturity	Seed Source	Marketable T/A	Cull T/A	Average fruit size (lb)
LS 0505	Banana	New 2008	NA	Long & Sweet LLC	7.7	0.6	0.09
LS 0509	Banana	New 2008	NA	Long & Sweet LLC	8.4	1.6	0.12
Pageant	Banana	Industry Std.	70 day	SI	6.9	1.8	0.11
Yummy	small orange snack type	New 2008	73 day	SW	5.8	0.02	0.06
LSD (0.05)					NS	0.51	0.10
CV					28.6	75.1	26.1

Evaluation of priming effects on sweet corn seeds by *SVIS*

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Summary

Two sweet corn seed lots of each hybrid *sh2* (`SWB 551´ and `Obsession´) were primed by a non-osmotic method (drum priming) at 25°C for 6 h. During each cycle, seeds were exposed to 6.0 mL of distilled water and then rotated in the drum for 1 h to ensure uniform absorption. After hydration, the seeds were incubated at 25°C for 0, 12, 24 and 36 h and dried under ambient conditions (25°C, 50% RH). Seed vigor imaging system (*SVIS*) evaluations were compared with standard germination and seedling emergence tests. The results obtained in this study confirmed that *SVIS* is a practical, valuable approach to evaluating the efficacy of priming treatments in sweet corn seeds when using a vigor index ratio of 70% growth index and 30% uniformity index for evaluating seed lots considered commercially valuable, but possessing low vigor.

Experimental and discussion

Sweet corn (*Zea mays* L.) seed has naturally low physiological quality compared to field corn (Rosenthal *et al.*, 2003). The increasing use of pre-germinated (priming) treatments with partial or normal seed imbibition has been recommended to decrease the time between sowing and seedling emergence (McDonald, 2000). In sweet corn seeds, hydropriming and osmopriming methods increased the uniformity of seedling emergence and reduced the range of days for germination (Bennett and Waters, 1987). Priming evaluation is normally conducted by germination assays (Capron *et al.*, 2000); however, for vigor analysis of seed lots, more precise, quick and efficient tests are desirable.

The Seed Vigor Imaging System (*SVIS*) is a vigor test that evaluates seed performance by scanned images of young (three-day-old) seedlings evaluated by computer software (Hoffmaster *et al.* 2005). In *SVIS*, seeds are germinated at 25°C, the resulting seedlings scanned and their length and uniformity analyzed using software that computes an overall vigor index (Sako *et al.* 2001). This vigor test provides a rapid and objective measurement of seed quality and the images and vigor indices are stored and a data base developed for future reference. Despite these advantages in vigor assessment, no information is available regarding the efficacy of *SVIS* and seed priming effects. The objective of this study was to analyse the effects of priming treatment on sweet corn seeds using *SVIS*.

Two sweet corn seed lots of each hybrid *sh2* (`SWB 551´ obtained from Dow AgroScience® in Jardinópolis, Brazil and `Obsession´ obtained from Seminis® in Oxnard, USA) were evaluated. Each seed lot was primed by a non-osmotic method (drum priming) following the procedure described by Warren and Bennett (1997). Seeds were hydrated at 25°C for 6 h. During each cycle, seeds were exposed to 6.0 mL of distilled water and then rotated in the drum for 1 h to ensure uniform absorption. After hydration, the seeds were incubated at 25°C for 0, 12, 24 and 36 h. The seeds were then dried under ambient conditions (25°C, 50% RH) until the initial seed moisture content (9.1 and 8.1% for `SWB 551′ and `Obsession′, respectively, on a fresh weight basis). Seed moisture content was determined before and after priming treatments using the low constant temperature oven method (ISTA, 2006) by drying at 103°C ± 2°C for 17 h, with two replicates of 50 seeds for each seed lot. After priming, the following studies were conducted:

Standard germination tests: All samples were germinated according to the between-paper (BP) method of germination described by ISTA (2006). Four replicates of 50 seeds each were placed equidistant apart on moist germination paper (76 x 38 cm, Anchor Paper Co., St. Paul, MN) and covered by another moistened germination paper. Tests were placed at 25°C and normal seedling evaluations were made following 4 and 7 d germination. The data of the first analysis constituted the first germination count test.

Seedling emergence tests: Seedling emergence tests were conducted in a plastic tray by planting seeds on kimpak (Anchor Paper Co, Minneapolis, MN, USA) and covered with a soil-sand mixture (50%-50%) and kept at 25°C 80% RH for 6 d. Emerged seedlings in each tray with a coleoptile at least 1 cm above the soil-sand surface were counted as germinated.

Seed vigor imaging system (SVIS): The *SVIS* procedure consisted of evaluating the scanned image of 50 seedlings taken after 3 days germination at 25°C. Based on the growth of the seedlings, the software computed a growth index and a uniformity index, both ranging from 0 (no germination) to 1000 (maximum germination). In addition, the program provided an overall vigor index which consisted of the sum of 30% of the growth index and 70% of the uniformity index, 50% of the growth index and 50% of the uniformity index and 70% of the growth index and 30% of the uniformity index. Four replications of 50 seeds each per treatment were analysed following the procedures described by Hoffmaster *et al.* (2005).

Seed moisture content before priming was 8.1 and 9.1% for `SWB 551′ and `Obsession′ hybrids, respectively. Seed moisture contents after priming and after incubation at 25°C for 12, 24 and 36 h treatments were similar, approximately 28%. After four d under ambient conditions at 25°C and 50% RH, the seed moisture content was also approximately 8%, similar to the initial seed moisture contents.

On average, `SWB 551′ seeds had standard germination values of 76% and 47% for lots A and B, respectively (Figure 1A). The maximum germination value for lot A was after 12 h priming at 25°C at 83% while for lot B, the control showed the highest value (55%). Results obtained for the first germination count and seedling emergence showed an increase when seeds from lot A were primed at 25°C for 12 and 36 h compared to the control (Figure 1B). For lot B, germination first counts were below 35% and no statistical differences were observed between the control and priming treatments. However, for seedling emergence, the control had a higher emergence than 0, 12 and 24 h priming treatments (Figure 1C). The results obtained in this study show priming was effective only for lot A which possessed a commercial germination value. Also, the seedling emergence test better detected differences among priming treatments compared to the first germination count test.

Growth index values from *SVIS* for `SWB 551′ lot A after 12 h priming were greater than the control (Figure 1D). Although maximum uniformity index was observed at 36 h priming, no differences were observed among *SVIS* treatments (Figure 1E). The weighting of the overall vigor index can be modified by the software based on the percentage weight given to growth (G) and uniformity (U). To examine the best weighting structure for sweet corn seeds, we established three different weighting factors. Based on these studies, weights of 50G+50U at 12 h priming and 70G+30U at 12 and 36 h priming were better than the control. No advantage to priming was observed for `SWB 551′ lot B; the growth index at 0 and 12 h priming and uniformity index at 0 h provided lower results than the control (Figure 1D). Similar results were obtained for all vigor values tested with the control having superior results compared to results for priming before 0 h and after 12 h incubation. Beneficial priming effects were only observed for lot A that had standard germination values above 70%. Differences between the control and 12 h priming and between the control and 36 h priming were observed for a vigor index using the 70G+30U ratio (Figure 1H). When comparisons were made for the vigor values using the ratios of 30G+70U and 50G+50U, differences were only observed between the control and 12 h priming treatments.

Standard germination values for `Obsession′ were 87% and 84% for lots A and B, respectively (Figure 2A); no differences were observed among times of incubation after priming. First germination count showed no differences among treatments. However, seedling emergence showed beneficial effects from priming for lots A and B with better results (96% and 93%) at 12 and 36 h priming, respectively (Figure 2C).

Differences in growth index between control and 36 h priming were observed for lot B (Figure 2D). No differences among treatments were found for the uniformity index, vigor index ratio of 30G+70U or vigor index ratio of 50G+50U. However, the vigor index ratio of 70G+30U showed differences between the control and 12 h priming for lot B (Figure 2H). These results demonstrate the value of using *SVIS* to evaluate seed priming efficacy of sweet corn lots. Seedling emergence values for lot B confirmed the same results for the vigor index ratio of 70G+30U. No differences were observed using the vigor index ratios of 30G+70U and 50G+50U. These results show that beneficial priming effects are not observed in seed lots with the same germination potential but do exist with seed lots possessing high physiological quality.

The results obtained for `SWB 551′ and `Obsession′ hybrids have demonstrated that high quality sweet corn seed lots respond positively to priming; however, priming is not beneficial for seed lots with medium physiological quality. The best treatment using the drum priming system was 36 h priming and, for this time, *SVIS* (vigor index ratio of 70G+30U) produced similar results as seedling emergence documenting this as a rapid seed vigor test that can identify the efficacy of priming treatments. *SVIS* provides advantages such as rapid measurement of seed quality, storage of images for later retrieval, and development of a data base for priming efficacy of differing seed lots for future reference. These attributes clearly demonstrate that *SVIS* is an enhancement over traditional vigor tests.

The results obtained in this study have confirmed that *SVIS* is a practical, valuable approach to evaluating the efficacy of priming treatments in sweet corn seeds when using a vigor index ratio of 70% growth index and 30% uniformity index for evaluating seed lots considered commercially valuable, but possessing low vigor.

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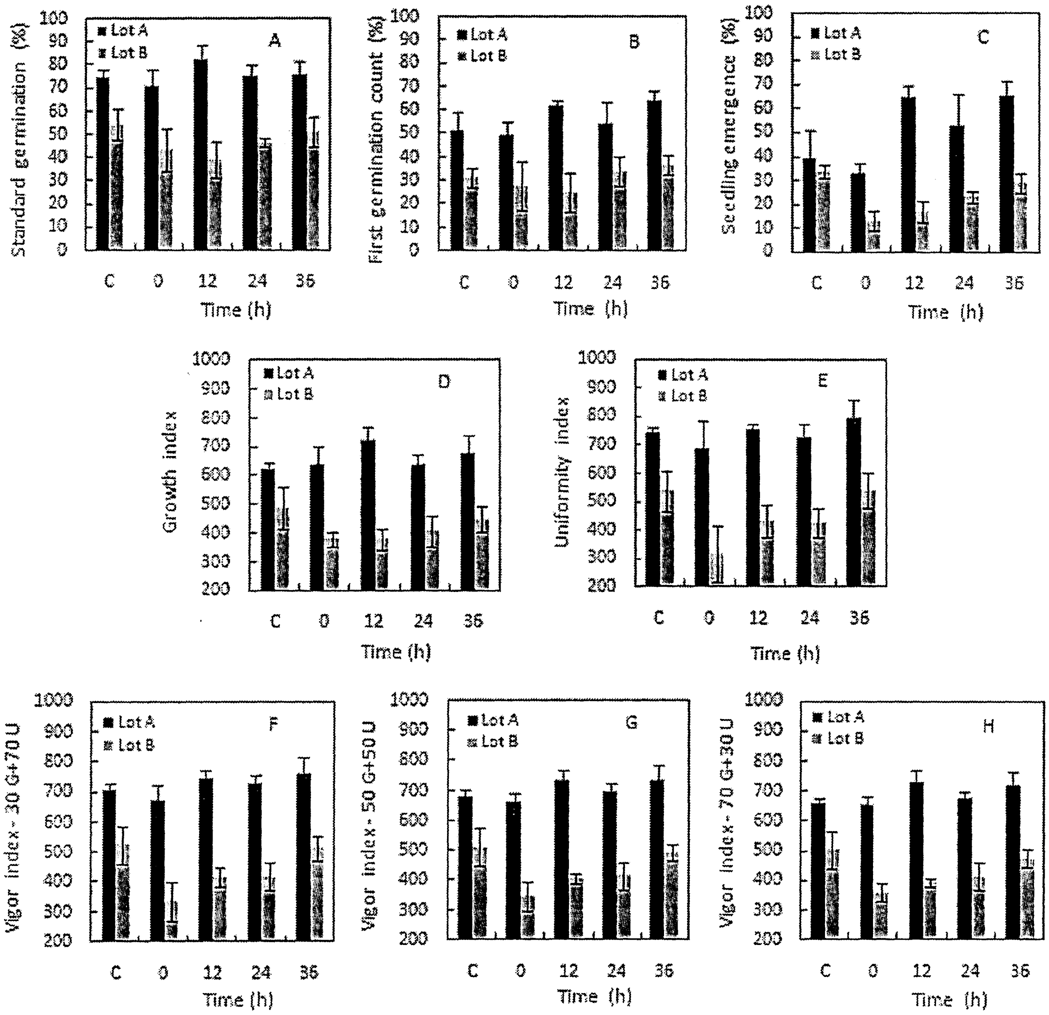

Figure 1. Standard germination (A), first germination count (B), seedling emergence (C), growth index (D), uniformity index (E), vigor index 30G+70U (F), vigor index 50G+50U (G) and vigor index 70G+30U (H) obtained by *SVIS* for two *sh2* sweet corn seed lots ('SWB 551') submitted to drum priming and incubated at 25°C for 12, 24 and 36 h. C (control) = non-primed seeds. Seeds from 0 h treatment were immediately dried after priming. Data are means ±SE of four replications of 50 seeds.

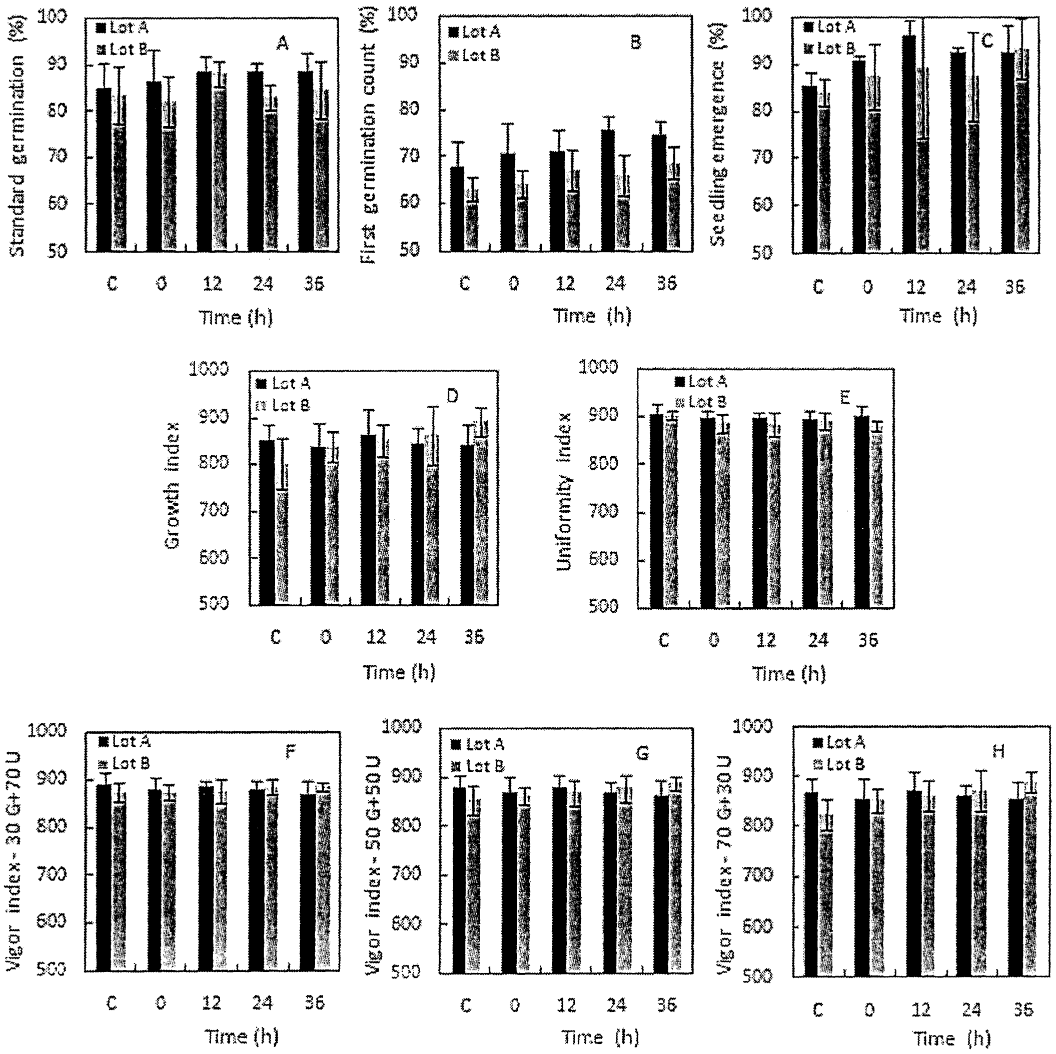

Figure 2. Standard germination (A), first germination count (B), seedling emergence (C), growth index (D), uniformity index (E), vigor index 30G+70U (F), vigor index 50G+50U (G) and vigor index 70G+30U (H) obtained by *SVIS* for two *sh2* sweet corn seed lots ('Obsession') submitted to drum priming and incubated at 25°C for 12, 24 and 36 h. C (control) = non-primed seeds. Seeds from 0 h treatment were immediately dried after priming. Data are means ±SE of four replications of 50 seeds.

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